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QUEENSLAND

REGIONAL EXPERIMENT STATION, BILOELA

PROGRESS REPORT FOR THE SEASON 1951-52

BY

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This summary has been prepared from the reports submitted by J. G. J. Stevens, J. Harbison and J. H. Teakle, of the staff of the Biloela Regional Experiment Station.

Climatic Data.

Full details of rainfall and temperature are given in Table 1. The main points of interest in the exceptionally dry season were:—

(a) The rainfall for the calendar year 1951 was 15·65 inches, only 0·97 inch higher than the total recorded in 1932, the lowest since the station was established.

(b) Although the October rainfall was not much below average it was of a scattered nature, and following the protracted dry period since February, was of little real value. The November rainfall (0·01 inch) was the lowest on record for that month and there was only one really beneficial fall before the end of 1951, when 1·12 inches were registered on 13th December.

(c) 21% of the rainfall during the year was torrential, 12·5% of medium intensity, and 66·5% of low intensity.

(d) With dry conditions prevailing from July 1951 to February 1952, maximum temperatures were above and minimum temperatures below average. Both the mean maximum temperature of 94° F. for November 1951 and the individual reading of 102·6° F. on 24th November were the highest ever recorded at the station in that month.

(e) The first frost of the season did not occur until 20th June.

Table 1.

Month	*Rainfall (inches)*		*Screen maximum temperature (°F)*		*Screen minimum temperature (°F)*	
	1951-52	1925-52 (means)	1951-52	1925-52 (means)	1951-52	1925-52 (means)
July 1951	0·28	1·30	73·3	70·9	36·5	40·1
August	0·83	0·61	73·8	74·8	34·8	40·4
September	0·41	0·94	82·0	80·3	44·0	46·2
October	1·74	1·94	86·5	85·3	54·6	54·7
November	0·01	2·84	94·0	88·7	61·0	60·4
December	2·32	2·81	94·8	90·6	64·8	64·3
January 1952	2·85	4·23	93·2	91·9	67·6	66·9
February	2·31	4·85	90·9	89·2	65·7	66·2
March	4·71	2·70	86·2	87·6	63·6	62·8
April	2·54	1·67	82·4	82·8	58·9	54·4
May	4·24	1·66	73·5	77·0	51·9	47·2
June	1·51	1·72	71·1	71·2	41·2	43·0
Year	23·75	27·27	83·5	82·5	53·7	53·9

Crop Growth.

The season under review was most difficult for summer crop planting, since there was no subsoil moisture in areas growing a summer crop last year, and in fallowed land there was a layer of at least eighteen inches of dry soil before contact with subsoil moisture was made. Consequently no planting was possible prior to December except in irrigated areas, where most of the cotton was planted during October following an irrigation of 3 inches. Germination and early growth were satisfactory, but another irrigation was necessary towards the end of November, when thinning was carried out followed by interrow cultivation. Further regular irrigations were necessary throughout the growing season until the March rain group.

Although insufficient rain was received during December to offset the drought conditions, a useful rain group totalling 1·70 inches between 13th and 16th December allowed of limited planting of dry-farmed cotton. Germination in these plantings was fairly good, but many seedlings were lost by burning off, leaving irregular stands which remained in a precarious condition until relieving rains occurred at the end of the first week in January. These rains changed the crop prospects considerably, as the raingrown cotton made a remarkable recovery.

All irrigated cotton grew well during January and, although only a light bottom crop of bolls developed, the plants produced squares and flowers profusely and shedding was negligible. In the irrigated cotton flowering commenced towards the end of January. The dry season enabled the moisture supply to be regulated so as to maintain a fairly constant level of flowering throughout the main flowering period. The resultant satisfactory yields of irrigated cotton probably reflect the well-timed waterings.

The yields of raingrown cotton, as a whole, were surprisingly good for such late plantings. Past experiences on the Experiment Station have indicated that only poor yields can be expected from December plantings. In this past season, however, yields of up to approximately 1,000 lb. of seed cotton per acre were obtained. The plants in most areas, under the combination of very limited rainfall and exceptionally low rates of soil nitrification, developed slowly during the first three months and as a result set and retained a crop much lower down than normal for such late plantings. This applied more particularly to cotton following grassland or sorghum. On old cotton cultivations where a greater rate of nitrification occurred, a much more vegetative type of plant developed which reacted adversely to stress conditions and produced only poor yields.

Early insect activity resulted in an average of 85% terminal loss on all irrigated cotton, the result being short bushy plants with an excess of basal and lateral vegetative branches. Although this plant type appeared to be unsuitable for mechanical harvesting, the I.H.C. spindle type of machine performed the operation reasonably well. The unusually low rainfall during the main summer months allowed weed and grass growth to be easily controlled.

Table 2 briefly summarises the results from all cotton trials on the Experiment Station for the 1951-52 season.

TABLE 2.

Crop	*Planting dates*	*Picking dates*	*Local close season*	*Rainfall*	*Mean temperature Oct.-Nov.*	*Mean yield seed cotton lb. p.a.*
Raingrown cotton	13-17 Dec.	1-20 July	Nil	Dec.-May inclusive 14·97	Max. 90·25 Min. 57·8	657
Irrigated cotton	15-25 Oct.	23 April 15 July	Nil	Oct.-May inclusive 16·71		1814

The total seed cotton production for the year was 34,594 lb. from 33·53 acres.

Intermittent rain delayed the cotton harvest and adversely affected grades, which improved somewhat during bright weather late in the season, but as a whole were considerably lower than normal for the Station.

PESTS.

In common with other years when no general crops were being cultivated through lack of spring and early summer planting rains, there was a heavy early infestation of corn ear worm on the cotton. During mid November egg-laying occurred in sufficient proportions to warrant immediate spraying, which was carried out with a 0·4% DDT emulsion. In December, intense insect activity necessitated two more sprayings, but despite the control measures taken, approximately 85% of the irrigated plants lost their terminals. In January, further egg counts did not disclose any additional insect activity. However, in February corn ear worm, rough bollworm and stainers made their appearance and a final spraying with 0·4% DDT was given.

Jassids appeared during February, but the attack was slight and of short duration. The frequent sprayings apparently kept this insect from breeding into large populations and it caused little damage. Although only a light crop of bottom bolls developed in the irrigated cotton, the middle and top crop formations were good and it would appear that a long range benefit was obtained from the earlier sprayings.

Agronomic Trials.

Time of Watering Trial.—This experiment was planted as a 4 × 4 randomised block experiment with four rates of spray irrigation (increasing from treatment A to treatment E). The E plots were given a 3-inch irrigation in mid September and the whole area was given a similar watering in mid October, following which the experiment was planted on 20th October to the variety Miller 41S. The average depth of moisture at planting was 26 inches in E plots and only 14 inches in A, B and C plots. A 3-inch irrigation applied to E and C plots at mid November and to B plots early in December assisted the growth of the plants in these areas, and all plots responded well to a rain group of 1·70 inches which fell between 13th and 16th December.

Stand and terminal loss counts made on 11th December gave a mean of 256 plants for 302 feet of row, while terminal loss ranged from 87%—90%.

Flower counts were commenced on 28th December. Initial counts indicated a low rate of flowering, but showed treatments C and E to be flowering more than A and B. The height of B plants increased rapidly during the first half of December, but at the end of the month the approximate heights in inches of all treatments were: A—12, B—15 to 21, C and E—18 to 24.

Flowering remained poor to the end of January, but improved appreciably thereafter. The counts for A plots were considerably lower than the rest, and the backward nature of these plots was also evidenced in plant height. Further irrigations were necessary at the beginning and end of the month owing to stress conditions.

Total flower counts per 100 foot row for the eleven week period ending 7th March were as follows: A—1562, B—1800, C—1851, E—1962.

At the end of February B and E treatments were opening well, and C treatment fairly well, while A had no open bolls. The experiment was machine-picked on 21st-23rd April and again at mid July. The yields are presented in Table 3.

As would be expected under the seasonal conditions, A plots gave the lowest yield. The high yields of the E plots were attributable to the additional irrigations, particularly the extra pre-planting irrigation in September. The B and C plots occupied an intermediate position, and their close approximation in yield indicates that little extra benefit was derived from the November irrigation in treatment C, as compared with the December irrigation in B.

TABLE 3.

Treatments	Yield s/c. lb. p.a.			Significantly exceeds	
	1st pick	2nd pick	Total	at 5% level	at 1% level
E—with 6×3 inch irrigations on 17th Sept., 15th Oct. (pre-planting), 13th Nov., 2nd Jan., 23rd Jan., and 6th Feb.	1647	437	2084	C.B.A.	A.
C—5×3 inch irrigations on 15th Oct. (pre-planting), 13th Nov., 3rd Jan., 24th Jan., and 7th Feb.	1460	414	1874	A.	A.
B—5×3 inch irrigations on 15th Oct. (pre-planting), 3rd Dec., 3rd Jan., 24th Jan., and 7th Feb.	1480	346	1826	A.	
A—4×3 inch irrigations on 15th Oct. (pre-planting), 3rd Jan., 23rd Jan., and 7th Feb.	1168	385	1553		
Means	1438	395	1834		
Minimum significant differences				5% — 119 lb. p.a. 1% — 275 lb. p.a.	

Irrigation Rotation Trial.—This trial, based on a 5 × 4 randomised block design with treatments as shown in Table 4, was planted with Miller 41S on 12th October following a watering of 3 inches on 8th and 9th October. A moderately good germination resulted. The area was thinned on 7th and 8th November. A heavy attack of corn ear worm in mid November was countered by spraying with 0·4% DDT emulsion. Nevertheless, terminal loss was heavy, and spraying was repeated in mid December.

At the end of November plants in all treatments were healthy, but were shorter in B plots (cotton following sorghum). Flower counts were commenced on 28th December, when the number of flowers in B plots was lower than in A and C (cotton following Rhodes grass and continuous cotton respectively). Height varied from 12 inches in B plots to 18 inches in A and C. Plants at this stage were showing signs of stress, but a 3-inch irrigation during the first week of January resulted in an increase in flowering, which remained satisfactory throughout the month.

The total counts for the 6 week period to 1st February showed considerably less flowering in B plots than in A or C. Flowering had virtually finished by the end of February. The figures for the two periods of the main flowering season are shown as follows:—

	A	B	C
Period 6 weeks ending 1st Feb.	1417	881	1184
Period 5 weeks ending 7th Mar.	2000	1357	1810

Bolls commenced opening in B and C plots on 11th February and in A plots on 19th February.

The dry land plots in the experiment were planted on 13th December. Although initial germination was good, by the end of the month seedlings showed marked signs of stress, and many died, thereby reducing the ultimate stand. The position was considerably relieved by 2·70 inches of rain on 9th and 10th January. Another fall of 2 inches in late February promoted strong growth of the plants, and at the end of the month flowering had commenced. Harvesting was completed at the end of June. Yield data for the treatments are shown in Table 4.

TABLE 4.

Treatment		*Yield s/c. lb. p.a.*	*Significantly exceeds*	
			at 5% level	*at 1% level*
A—3 years cotton following 3 years Rhodes grass	Irrigated	1933	C.B.S.R.	B.S.R.
C—Continuous cotton	Irrigated	1733	B.S.R.	B.S.R.
B—Sorghum-cotton alternate rotation	Irrigated	1364	S.R.	S.R.
S—Sorghum-cotton alternate rotation	Dry land	722		
R—3 years cotton following 3 years Rhodes grass	Dry land	671		
Necessary difference for significance		5% 175 lb. s/c. per acre 1% 243 lb. s/c. per acre		

The cotton grassland rotation under irrigation, as would be expected, produced the greatest yield, although the continuous cotton treatment yielded only 200 lb. of seed cotton per acre less. The season, however, was one in which available nitrates in old irrigated cultivations were not sufficient to stimulate the excessive plant growth which is characteristic of seasons with more normal rainfall. In the B plots the previous sorghum crop utilised so much of the available nitrates that the decomposition of the ploughed-in sorghum plants was greatly retarded. This resulted in a deficiency of nitrates during the growth of the following cotton crop.

Irrigated Varietal Trial.—This trial was planted to a 6 × 4 randomised block design on 22nd October. A 3-inch irrigation given on 19th October provided wet soil to a mean depth of 14 inches at planting time. Germination was fairly good and subsequent early growth was normal. The trial was thinned out on 14th and 15th November and was then given another 3-inch irrigation which wet the soil to field

capacity down to an average of 34 inches. Similar irrigations were found necessary at approximately monthly intervals until March.

Heavy egg laying by corn ear worm moths necessitated spraying in the third week of November and again in mid December, but in spite of these sprayings, terminal losses averaged 83% over all varieties. Flowering commenced towards the end of December and continued at a very uniform rate during January and February. This regularity was a reflection of the well spaced irrigations made possible in a season of lower than average rainfall.

The total flower counts per 100 feet of row for the 11 weeks ending 7th March, when counting was discontinued, were as follows:—

Miller 41S	*Miller 43·9·0*	*Empire*	*Stoneville 2B*	*Acala 4·42*	*Coker 100*
2023	2173	2153	1888	2022	2490

Coker 100, which was included in this trial for the first time, had a clear lead over other varieties in number of flowers produced. Bolls commenced to open at the end of March and the first picking was made on 10th April. Details of the season's yields are shown in Table 5.

TABLE 5.

Variety	*Yield lb. s/c. p.a.*			*Significantly exceeds*	
	First pick	*Second pick*	*Total yield*	5%	1%
F. Coker 100 S8	1565	1167	2732	C.D.E.	D.E.
B. Miller 43.9.0	1507	875	2382		
A. Miller 41S	1478	904	2382		
C. Empire	1575	773	2348		
D. Stoneville 2B	1016	1133	2149		
E. Acala 4.42	1682	447	2129		
Means	1470·5	883·2	2354		

Minimum significant difference for total yield { 5% — 364 lb. per acre; 1% — 504 lb. per acre }

The yield of 2732 lb. of seed cotton per acre produced by Coker 100 strain 8 is the record yield obtained at the Station. Stoneville 2B, which in past years has usually been amongst the leaders in the irrigation varietal trials, was this year only in fifth position.

Dry Land Cotton Varietal Trial.—This trial, a 10×6 randomised block experiment, was planted on 17th December following a storm group which yielded 1·70 inches of rain and gave 7·5 inches depth of wet soil. A fair germination was obtained, but the seedlings were in urgent need of rain when relief came on 9th and 10th January. This 2·70 inch rain group wet the soil to 18 inches and did much to establish the trial. At the end of January the cotton was 5-10 inches high with the first squares appearing on the larger plants.

Flowering commenced about 20th February and at this time square development was quite good. The plants at this stage were inclined to be small, which had helped them to escape stress periods. By the middle of March an average of approximately 3-4 green bolls was present per plant, but the flowering rate had decreased until the relief rain which fell on 15th March caused a renewal of growth and a significant rise in flowering. Very little cotton was open at the end of April and the later maturing Miller backcross strain was laden with squares. Flowering continued in all varieties until frosts occurred. Picking commenced on 7th July and the yields presented in Table 6 are surprisingly high for such late planted cotton.

TABLE 6.

Variety	*Yield s/c. lb. p.a.*	*Significantly exceeds*	
		at 5% level	*at 1% level*
1. Rowden	1059	4-10	4-10
2. New Mexico Acala 120 BS	1032	4-10	4-10
3. Acala 5675.10.2	977	4-10	4-10
4. Miller 610	844		
5. Rogers Acala	842		
6. Empire	813		
7. Miller 41S	810		
8. MBC 8	794		
9. Acala 4.42	793		
10. Miller 43.9.0	793		
Mean	876		
Minimum differences for significance	5% — 98 lb. per acre 1% — 131 lb. per acre		

MECHANICAL HARVESTING.

The season was not by any means ideal for efficient functioning of the mechanical harvester. In the first place, plant type was unsuitable, an average of 85% terminal loss sustained in the early growth of the plants causing considerable lateral growth. In addition, frequent short wet periods during the first half of the harvesting season matted the cotton in the bolls and reduced grades. Nevertheless, it is considered that the mechanical harvesters operated satisfactorily.

Two trials were planned for mechanical harvesting tests, namely an irrigation trial of 8 varieties, and a raingrown trial of 10 varieties.

Irrigation Trial.—This was planted without replication in 20-row plots. Planting followed a 3-inch watering on 17th-19th October, and a further irrigation was given from 19th-21st November as a result of which soil moisture depth averaged 34 inches. Irrigation and insecticidal spraying were carried out when necessary for the rest of the season. Flowering was fair at the beginning of January, but im-

proved rapidly towards the end of the month; boll formation was good. At the end of January a series of observations was carried out in order to give some idea of the number of squares and bolls and the extent of leafiness in the varieties under trial. No differences were found in leafiness but, in regard to number of squares and bolls, MBC8 was the poorest with Acala 4·42 only slightly better, while Miller 41S and 43.9.0 and Stoneville were the best.

Bolls were opening by 1st March and the first harvesting was done on 23rd April. Table 7 shows the yields per acre and the relative machine efficiency for the first and total harvests.

Table 7.

Variety	*First pick*		*Total*	
	Lb. s/c. harvested per acre	*Percentage of open crop harvested*	*Lb. s/c. harvested per acre*	*Percentage of crop harvested*
Miller 41S	1507	69	1830	91·7
Miller 43.9.0	1635	76·5	1990	93·4
Triumph 39.2.1	1376	61·0	1716	82·2
Empire	1843	78·2	2151	84·6
Stoneville 2B	2064	78·8	2411	89·5
Acala 4.42	1758	78·3	2074	88·1
Coker 100	1886	79·5	2248	90·9
MBC 8	1608	84·3	1981	89·7
Means	1710	74·46	2051	88·76

Although varietal suitability rather than the amount of cotton harvested influenced the relative efficiency of the machine at the first picking, the low mean percentage of 74 suggests that a crop of over 1200 lb. of seed cotton per acre is excessive for the machine to harvest efficiently in one picking when the plants are green. A mean of some 400 lb. seed cotton per acre was left on the plants at the first picking, but was mostly harvested in the second picking after the leaves had fallen. Severe frosts in late June caused leaf drop which enabled a reasonably satisfactory grade to be obtained for the second picking, although it contained much cotton that had been on the plants for a long period during which frequent rains had been experienced. The average grade of this picking was strict low middling, compared with middling light spot for the first picking.

Raingrown Trial.—This experiment was laid down as a 10-variety trial without replication, each plot comprising 10 rows. As the normal planting period passed without adequate rainfall, a pre-planting irrigation of 3 inches was given to make possible the establishment of a trial offering prospects of reasonable yields. With the very dry conditions it was found necessary to give three additional light irrigations totalling 6·5 inches through the growing season to supplement the natural rainfall, so that strictly this was not a dry land trial.

A good germination was obtained, and by the end of December plants were 5-7 inches tall and growing well. First squares appeared by mid January, and by the end of the month first flowers appeared. Bolls commenced to open by the end of March, and the crop was well opened by the middle of June when the first frost occurred. The trial was harvested mechanically on 11th July. The efficiency of the machine varied from 87% for Acala 4.42 to 70% for Triumph, the mean being 82%. Triumph was the only variety that gave any difficulty in harvesting; this variety provided badly shaped low bushes with long slender vegetative branches. Yields varied from 674 lb. seed cotton per acre for Empire to 456 for Acala 4.42, the mean being 585 lb. per acre. The average grade for this picking was strict low middling.

Cotton Breeding.

Work continued in the jassid resistant backcross Miller strains; further plant selection was carried out in the main progeny plot of these strains, which yielded satisfactorily under the dry conditions. Several promising progeny increases were retained for multiplication and testing, and a number of new individual plant selections were taken for laboratory tests. One strain (MBC5) which has an ideal plant type for mechanical harvesting and gave the highest yield in a Miller strain trial, has a lint percentage lower than the main commercial varieties. Selection work aimed at improving this factor is to be continued.

Unfortunately, the strains that were released for commercial plantings last year were in almost all cases held over owing to the lateness of the planting rains, but these should be planted during the coming season.

Entomological Investigations.

An irrigated trial to examine the merits of various sprays for the control of *Heliothis armigera* was carried out as a 5×5 randomised block experiment. It was planted on 17th October to Miller 41S following a 3-inch irrigation given on 10th and 11th October. Soil moisture was present to an average depth of 16 inches at planting time. Germination was fairly good and a healthy stand resulted. A further 3-inch irrigation was given in mid November.

A heavy laying of eggs by *Heliothis* moths occurred in mid November, following which the prescribed sprays were applied at the rate of 18-20 gallons per acre.

During December the cotton made fair growth and as insect activity was fairly intense (100 eggs per 100 terminals), the respective treatments were again applied on 12th December at the rate of 18 gallons per acre and on 22nd December using 30 gallons per acre. A further 3-inch irrigation was given late in January.

Plants made little terminal growth in February, but continued squaring and flowering well. Egg counts early in the month averaged 13 per 100 terminals and a further spraying was carried out on 5th February using 40 gallons per acre of the respective treatments.

DDT treated plots provided the highest flowering rate throughout the experiment. Flowering was poorest in the Dieldrin plots until February, when this treatment provided the highest counts over the last two weeks.

By the end of February a number of bolls were opening. The average plant size was relatively small (approximately 23 inches in height), and the light green foliage colour indicated nitrate deficiency. The lack of available nitrates is accounted for by the fact that the growing period was not one in which conditions were suitable for high nitrification; in addition, the cotton followed a sorghum crop. Under these conditions, a large plant structure and high yields were not to be expected.

Cotton was sufficiently open by June to allow the first picking to be made. The final picking was carried out on 9th July. The yields are presented in Table 8.

TABLE 8.

Treatment	*Yield s/c. lb. per acre*			*Significantly exceeds*	
	First pick	*Second pick*	*Total pick*	*at 5% level*	*at 1% level*
DDT—0·4%	1459	89	1548	All others	Dieldrin
BHC Gammexane No. 7 miscible oil—1 in 200	1257	142	1399		
E605—0·015% (2 oz. Folidol per 20 gals.)	1251	136	1387		
Dieldrin—0·15% (8 oz. commercial product per 20 gals.)	1226	153	1379		
Untreated	1256	131	1387		
Minimum significant difference for total yield			5% — 120 lb. s/c. per acre 1% — 166 lb. s/c. per acre		

Received January 1953.